Challenges of Smart Cities: How Smartphone Apps Can Improve the Safety of Women

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***Abstract*—Smart cities promote the use of emerging technologies to revolutionize the way we live and interact, making it safer to live in community creating an environment where women and men can feel safe. Unfortunately in regular cities, many women and young people have been involved as victims of reported situations such as harassment, assaults, kidnapping, robbery, human trafficking and femicides. Due to these situations, smartphone apps have been created so public utilities are more efficient and generate an atmosphere of safety specially for groups that can be vulnerable, as well as helping lower the rates of crime and contribute to safety of citizens. In this study, we analyze the safety situation of women in diverse countries and the impact of the smartphone apps that provide security to women. Finally, we present a smartphone app called Circle Armored that serves as an example of the type of apps that could prevent or assist during violence situations.**

***Index Terms*—Smart Cities, Artificial Intelligence, Safety, Women.**

I. Introduction

Smart Cities are the result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic and competitive performance of cities. Such smart cities are based on a promising mix of human capital (e.g. skilled labor force), infrastructural capital (e.g. high-tech communication facilities), social capital (e.g. intense and open network linkages) and entrepreneurial capital (e.g. creative and risk-taking business activities) [1]. In fact, the Inter-American Development Bank (IDB) highlights how the integration of technological development makes cities more innovative, more competitive, more attractive, and more resilient. [2]

Smart cities intend to improve the citizens lives in general, however, we as a society still face some challenges in our daily lives turning security into one of our main concerns specially for vulnerable groups of population such as women.

Violence to women has increased exponentially in the recent decades, which unfortunately has represents the fact that many lives have been lost around the world. As a response to this, some developers have created smartphone apps that can make citizens feel safer in cities that are overpopulated. An interesting fact is that according to IDB, 70 percent of the world's population—more than 6 billion people—will live in cities by 2050, according to the UN. [3] That said, it is of utmost importance to think about the applicability this would have in the present for a long period of time to many of the Smart Cities that are on the road and their inhabitants, specially women, to stop suffering from harassment, assaults, kidnapping, or even harder problems such as femicides.

In this study, we analyze the safety situation of women in diverse countries and the impact of the smartphone apps that provide security to women. Section II describes the current safety situation around the world, in section III we analyze the particular case study of Mexico City and in section IV we provide an overview of the diverse apps created to increase safety of women. In section V, we describe an app called Circle Armored that serves as an example of the type of apps that could prevent or assist during violence situations such as assaults, kidnapping, robbery, human trafficking and femicides. Finally, in the last section we present some conclusive remarks and directions for future work.

II. Violence Women experiment around the world

Regrettably, women around the world face a high risk of violence from people who are close to them whether in their homes, workplaces, streets, and schools. According to the United Nations Office on Drugs and Crime between 2005 and 2012, up to 55 percent of all female homicide victims were killed by intimate partners or family members, [4] U.S News site reports that also male homicide victims cases were reported as the same situation but in less than 20 percent [4].

"The organization Stop Street Harassment reports that women feel more harassed in cities like Mexico City, Delhi, Bogota, Lima, and Jakarta, but they also reported that the worst cities for physical harassment are Mexico City, Bogota, Lima, Tokyo, and Delhi". Another study performed by ActionAid showed that 79 percent of women living in cities in India, 86 percent in Thailand, and 89 percent in Brazil have been subjected to harassment or violence in public, as had 75 percent of women in London, UK, [6] this linked to higher rates of assaults and kidnapping of women.

Regrettably, many countries have received recommendations to change this global problem, some of the most alarming examples are:

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- Afghanistan with 93 percent cases on public harassment, 87 percent cases on workplaces, 89 percent on educational institutions, and 24 percent have ended in kidnapping people for human trafficking. [5]
- Australia with not only women experiencing harassment but also LGBT community who are reported as experiencing this situation in 65.1 percent comments, 63 percent, car horn honking 63.3 percent, wolf-whistling 41.1 percent and unwanted conversations 42.5 percent. The average value of kidnapping in Australia during 2008 to 2017 was 5.5 kidnappings per 100,000 people with a minimum of 2 kidnappings per 100,000 people in 2017 and a maximum of 19.1 kidnappings per 100,000 people in 2008. [5]
- Chile reported on 2015 that street harassment on women reached 85 percent and of men 55 percent, also, two in five people have suffered rubbing, touching or groping in public spaces, and 23 percent of women have experienced some form of serious harassment, the Chilean kidnapping rate during 2003 to 2017 was 1.4 kidnappings per 100,000 with a minimum of 0.7 kidnappings per 100,000 people in 2004 and a maximum of 1.9 kidnappings per 100,000 people in 2011. [5]
- China with the specific case of Beijing reported that 70 percent of the citizens had been sexually harassed, mostly on public transportation, in 2018, there were around 2.79 million theft crimes committed in China. This made theft the most common crime committed. [5]
- Costa Rica had 61.7 percent of women and 32.8 percent of men as victims of street sexual harassment in 2015, in 2019, eleven people were murdered per 100,000 inhabitants. [5]
- India with the specific case of Delhi, reported in 2016 that 40 percent of women had been sexually harassed in a public space such as a bus or park with most of the crimes occurring in the daytime, in 2016 the kidnapping rate was 5.1 kidnappings per 100,000 people. [5]

  A fact worth noting is that worldwide nearly 2.5 million cases of sexual violence had been reported in 2014, according to the United Nations Office on Drugs and Crime, with many countries reporting more than 100 instances of rape or sexual assault per 100,000 people. [5]

  In the case of this paper for developing a more specific study it was decided to choose Mexico City, which has been described as one of the cities where women run a higher risk of living dangerous situations.

III. Case study: Mexico City

In the case of Mexico City, it is inevitable to think that the city is moving to a more digitized society as well as building systems that help Mexican citizens to reach goals and be part of the Smart Cities communities, which opens a big opportunity for developers of emerging technologies to think about how with the democratization of technology solutions to the problem can be created with the use of technological advancements.

True is that nowadays Mexicans are facing a huge amount of femicides in Mexico as a country but also many cases are happening in Mexico City and Tlalnepantla which is located in the State of Mexico. According to *Statista* just in 2019, it was estimated that over 1.5 per 100,000 Mexican women were murdered on account of their gender, the highest rate at least since 2017. [7]

Certainly, the Mexican authorities have though about some solutions to solve the problem like a plan to stop the wave of femicides, more access to justice, as well as campaigns of prevention, but it has missed one key point that could help to reach contact with the victims in a faster way, which is using smartphone apps first of all to prevent new cases and secondly for detecting when victims can be in dangerous situations. Fortunately, worldwide organizations such as United Nations Economic and Social Council, UN Women, United Nations Population Fund, the International Justice Mission, Genocide Intervention, Global Fund for Women, Global Rights, World Health Organization (WHO), [5] and many other organizations, have sought to have their voices heard so that governments and enterprises can help create solutions to avoid problems related to the security of citizens on a global scale.

Enterprises who have taken action to this call have created smartphone applications for helping citizens to prevent scenarios with violence and have faster reports to the police so that crimes can be prevented in an easier and faster way.

IV. Smartphone apps to Improve Safety of Women

- Circle of 6, is an application created in 2011 by Joe Biden and Aneesh Chopra for stopping abuse in High School students, it works by giving two taps so the circle of 6 people the user chooses receive a message and can reach the user to prevent an assault. Worth to note is that it won The White House's "Apps Against Abuse" technology challenge in 2011, it works in 36 countries on Android and iPhone. [8]

  However thinking about an scenario where a person is running a huge risk it is somewhat acquitted because in real life it is not easy to take out the cellphone and press a button twice to issue an alert when victims face such situations, as well it has another disadvantage which is not counting on any system that can send the GPS location immediately to the trusted contacts which could help to prevent faster an attack to the user.
- Another example of smarphone app is the Toranj app, which was created for helping to create a circle of friends who will be alerted in a dangerous situation, according to its website Toranj acts as a method of instantaneous communication, notifying trusted friends of a victim's abuse the moment it begins."*Victims can safely and discreetly send a series of pre-drafted text messages to selected contacts, Legal documents and guidelines pertaining to victim rights and the filing of abuse complaints*" are also

available to read and examine on Toranj website, also its users can read different educational resources pertaining to a healthy understanding of relationship, another action that this app can perform is creating a list of suggested, local experts who survivors may contact for support: family attorneys, counselors, law enforcement officers, and advocates, it also have Relationship Assessment where users can complete an assessment of their current relationships with others." [9]

It is available in Iran for lowering the domestic violence rate and has been downloaded over 40,000 times. Unfortunately, this application has a huge disadvantage which is not counting with a system that can identify human activity in order to know what is happening with the victim and know how much time authorities and trusted contacts have to stop the dangerous situation, it is also lacking on a system that can recognize the speech of the victim and the aggressor and have a better clue on how to act so that the user can be safe, turning that into a great concern for the user and mostly its trusted contacts, because if there was a hazardous scenario where a victim is in danger they would not have any access to what the user is saying.

- A different application is bSafe- Never Walk Alone, created by Mobile Software AS, according to their website "is the most in-demand and beloved safety app in the world and well-positioned to become a disruptor of the public safety and security market". It works with Voice activation, live streaming and recording, it also has a function called "Follow Me" which invite people the user trust to walk with via live GPS tracking-now so the user never has to walk alone again, it also has a function of Fake Call which helps users to fake a Call to escape from an unpleasant or hazardous situation. Another interesting option it has is sharing the user location through a Button named "I'm here", it lets the user share their exact location with its trusted contacts. It is available worldwide in English and Norwegian language, with the possibility to work on Android and iPhone. [10] Certainly this application still needs to have some changes because for the scenarios that most of the victims face it is needed a better recognition of human activity that would make it easy to recognise the activity the user is performing, such as running,jogging, or other type of movement, and in case there is a hazardous action like trying to escape from a car, or getting out of the arms of some aggressor it could send an instant alert to their trusted contacts which would absolutely help to prevent a worse scenario.
- CrimeRadar is also a great example of Smartphone application that advocates for security and prevention of crimes, it was created in 2016 in Rio de Janeiro, Brazil, for detecting crimes using machine learning, its software works carving the city into sectors of 250 square meters and predicts crimes based on time and place of origin, it also aims to reduce crime rates and alert people of assault, kidnapping and robbery zones. Unfortunately this application does not considers sending any kind of alert when a person is being followed, or even analyzing the activity that a user is performing, in an scenario where a lady is being kidnapped in one of those red zones it would not let her trusted contacts to know she is being kidnapped and act immediately to stop the situation. [11]

V. Circle Armored APP

With the previous examples it was studied how some Smartphone Applications have previously worked to connect cities and citizens in a faster way in order to lower the rates of crimes and make people feel safer when they are on dangerous situations. Into this matter, Mirai innovation Research Institute with collaboration of Armored Mex Company decided creating an application for Mexico in order to lower the crime rates and help Mexican citizens feel safer while taking public transportation, walking on the streets, and other situations. The Smartphone Application is called Circle Armored APP, which first aim is to protect people by monitoring their physical activity which could include jogging, running, laying, rolling in a surface, jumping obstacles, trying to scape from the arms of an aggressor, and many other actions, as well as listening to keywords to ask for help, or listening the words that a criminal would say when trying to hurt the victim, it works with artificial intelligence for detecting speech recognition of users who feel in danger which makes it more accurate than other applications due to its algorithms. As well for having an easier recognition of the problem it works detecting human activity recognition through the accelerometer of the phone and the gyroscope, moreover for having better accuracy it was programmed with Random forest which gives an accuracy of 65 percent to 68 percent, and LSTMI that has 91 percent to 89 percent accuracy.

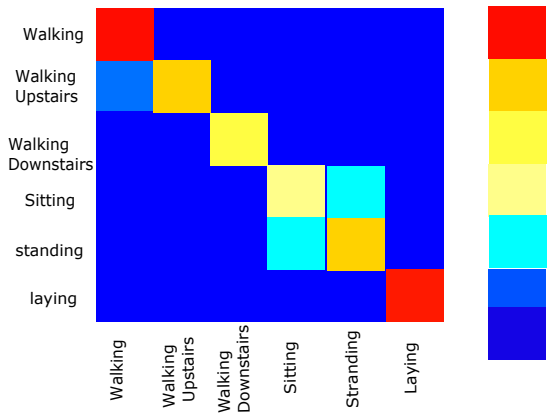

Fig. 1. Confusion matrix showing the accuracy of the predicted activity.

As shown in Fig. 1 it has an scale of danger which can recognize when the user is walking or even laying to have a better approach to the situation the user is experiencing.

As seen in Fig. 2 the process it has for working is at first glance detecting the dangerous situation through Speech Recognition and Human Activity Recognition, then it goes through Artificial Intelligence Algorithms to detect which type

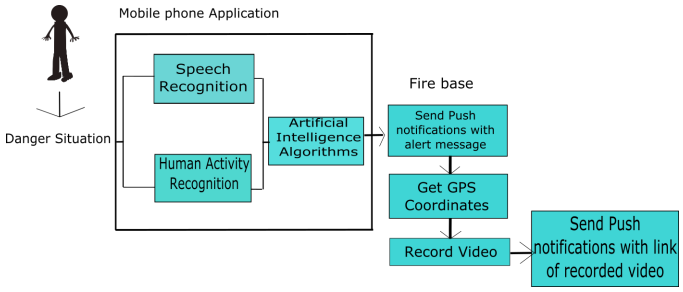

Fig. 2. Processes of the input data to obtain the prediction.

of situation the user is facing, afterwards the information is send to a fire base that will send push notifications with alert messages, then it will send GPS Coordinates and will also record a video, in the last part of the process it will send a push notification with a link of the recorded video.

With this application, we aim to help Mexico City authorities to find a new route to first of all lower the rates of femicides and violence and secondly to make Mexican women feel more safe around the streets, at their homes, workplaces, public transportation, schools, and many other places. Since we worry about the high rates of violence that Mexico has presented in the last decades, we aim to also contact organizations that may find this app useful so that women that work in this organizations can access to this application, help us to create future versions of the app that can work in a more efficient way, as well as helping us to have a better promotion in different social fields to reach as many women as we can, we also aim to collaborate with universities such as the National Autonomous University of Mexico, Universidad Iberoamericana,Monterrey Institute of Technology and Higher Education, and other institutions to create specific versions that work in a friendly way with their students and professors. Another important point we propose is going to marginalized communities where there are high rates of women suffering violence, to see how can we adapt the application to their needs so they can live safely. This application is going to be available in languages such as Spanish, English and French.

VI. Conclusion

For concluding this work it is important to think that nowadays having the possibility of accessing so easily to a smartphone has given us as a society the power to act differently in hazardous situations, true is that with collaboration of other authorities we still need to work harder to prevent such situations in the whole world more specifically in Smart Cities.

Collaborating for this work was also a challenge for getting to know which are the specific places that are the most insecure and find strategies to put users in a safer situation.

Into this matter, we know that we still need to work on mapping routes where more cases are presented so that the users of the app can try to avoid such zones and aware their relatives to also choose other routes for developing their activities.

We are also aware that this application is only a way of approaching to the problem and that we as civil society still need to work on new strategies for creating a better environment that will help more people to reach better opportunities that will lead to lower the violence rates.

We as developers think that with this type of contributions to society we can help many citizens that feel insecure in their cities to find a better solution that will make them feel safer as well as their families and communities in order to prevent hazardous scenarios like kidnaps and in the case of a metropolis that has presented more cases related to femicide try to lower the rate of this crime.

Acknowledgment

We thank Armored Mex for helping to develop Circle Armored APP with collaboration of Mirai Innovation Research Institute.

References

[1] Kourtit, Karima and Nijkamp, P.. (2012). Smart cities in the innovation age INTRODUCTION. Innovation-the European Journal of Social Science Research - INNOVATION. 25. 93-95. 10.1080/13511610.2012.660331.

[2] Inter-American Development Bank. (2016). The Road Towards Smart Cities. Taken from https://publications.iadb.org/bitstream/handle/11319/7743/ la-ruta-hacia-las-smart-cities-Migrando-de-una-gestion-tradicional-a-la- ciudad-inteligente.pdf

[3] United Nations. (n.d.). Worlds Population Increasingly Urban With More Than Half Living In Urban Areas — UN DESA — United Nations Department Of Economic And Social Affairs. UN DESA — United Nations Department Of Economic And Social Affairs. Retrieved June 14, 2020, from https://www.un.org/development/desa/en/news/population/world-urbanization-prospects.html

[4] Deidre McPhillips. (2014). Announcing the 2013 Violence Against Women Best Article Award Winner. Violence Against Women, 20(12), 14031403. Retrieved June 14, 2020, from 10.1177/1077801214564136

[5] (2018). GLOBAL REPORT ON TRAFFICKING IN PERSONS 2018. UNITED NATIONS OFFICE ON DRUGS AND CRIME Vienna. Retrieved June 14, 2020, from https://www.unodc.org/documents/data-and-analysis/glotip/2018/GLOTiP2018BOOKwebsmall.pdf

[6] Watts, M. (2016, May 19). Half Of Women Feel At Risk Of Harassment On London Public Transport.Evening Standard. Retrieved June 14, 2020, from https://www.standard.co.uk/news/transport/half-of-women-feel-at-risk-of-harassment-on-london-public-transport-a3252051.html

[7] (n.d.). Femicide Rate In Mexico 2019 — Statista. Statista. Retrieved June 14, 2020b, from https://www.statista.com/statistics/979065/mexico-number-femicides/

[8] (n.d.). Circle Of 6. Retrieved June 14, 2020d, from https://www.circleof6app.com

[9] (n.d.). Toranj Mobile Application - NetFreedom Pioneers. NetFreedom Pioneers. Retrieved June 14, 2020e, from https://www.netfreedompioneers.org/toranj-mobile-application/

[10] AS, M. (n.d.). BSafe " Never Walk Alone. Retrieved June 14, 2020, from https://getbsafe.com

[11] CrimeRadar. (1970, January 1). CrimeRadar. CrimeRadar. Retrieved June 14, 2020, from https://rio.crimeradar.org/?at=-22.865